

*REMARKS*

In response to the Official Action mailed January 30, 2004, Applicants amend their application and request reconsideration. No claims are cancelled and claims 21-28 are added in this Amendment so that claims 1, 9, and 13-28 are now pending.

Claims 9, 13, and 14 are allowed.

In this Amendment dependent claims, 17, 18, and 20, are amended merely for clarity. As previously discussed, claim 17, a dependent claim directed to an electric field emission electron source, encompasses the embodiment of the invention illustrated in Figures 17 and 18 of the patent application. In the embodiment of Figure 17, a cathode electrode 24 supplies electrons to the carbon body 9. Electrons are extracted from the carbon body 9 in response to an electric field supplied by an extraction electrode 25 that surrounds the body of carbon 9. As is apparent from Figure 17, when the body of carbon is viewed perpendicular to the substrate 1, the extraction electrode 25 does not overlap the body of carbon.

Dependent claim 18 encompasses the embodiment of Figures 19 and 20. That claim is clarified by explaining, as schematically illustrated in Figure 19, that the cathode electrode is between the body of carbon and the backside extraction electrode. In the embodiment of Figure 19, it can be seen that the electrons are emitted from the carbon body 9 which is supplied an electrical current through the cathode electrode 24. The cathode electrode 24 is between the carbon body 9 and the extraction electrode 27. The amended form of claim 18 makes this arrangement clearer and clarifies that the electrons are emitted from the front side of the body of carbon.

Claim 20 is amended only with respect to an issue of form. It is apparent in studying Figure 23, an embodiment which falls within the scope of claim 20, that the cathode electrode 24 is positioned beyond the backside of the extraction electrode 27 and does not overlap that backside extraction electrode when viewed in a direction perpendicular to the substrate 1.

Independent claims 1 and 15 are amended to remove an unduly limiting limitation. The body consists essentially of carbon, i.e., is pure carbon with only residual impurities, but is not limited to a single phase.

All of the claims still rejected, namely claims 1 and 15-20, were rejected as anticipated by Choi et al. (U.S. Patent 6,504,292, hereinafter Choi). This rejection is respectfully traversed.

As described repeatedly in the prosecution of this patent application, in one aspect, the invention is directed to a body consisting essentially of carbon. With regard to both of

claims 1 and 15, that structure includes an substrate, and, on the substrate, a body essentially consisting of carbon. That carbon body has a plurality of continuously connected intersecting walls. The walls are transverse to the substrate. This description is particularly important in understanding the invention and why the invention is different from the prior art now applied in rejecting claims 1 and 15, the two rejected independent claims.

Carbon, in its common forms, is an electrically conducting material. The carbon within the body of carbon is described in the patent application having the structure of graphite, a hexagonal crystalline structure. Graphite is well known to be electrically conductive. Thus, because the structure claimed includes a plurality of “continuously connected intersecting walls”, it is apparent that the body of carbon of the claimed structure is continuously connected electrically. Stated another way, two electrical terminals attached to any arbitrary locations of the body of carbon of the claimed structure have electrical continuity through the body of carbon.

In applying Choi to reject independent claims 1 and 15, the Examiner particularly directed attention to Figure 3B of Choi, erroneously asserting that “the intersecting walls of body 5 as shown in figure 3B of Choi” constitutes “a plurality of continuously connect [sic] intersecting walls...”.

What is shown in Figure 3B of Choi is not a carbon body having a plurality of continuously connected intersecting walls. What is shown in Figure 3B of Choi is the same as what is shown in Figure 2B of Choi, but with a metal film 5 deposited on “nanostructures 1”. According to the description of Figure 2B appearing in column 4, lines 33-41 of Choi, Figure 2B results from continuing growth of the relatively short carbon nanotubes shown in Figure 2A of Choi. The result of this continued growth is not a plurality of continuously connected intersecting walls. The result of this continued growth, according to Choi, is “an entangled mass 4.”

According to Choi, no matter which of the carbon nanotube structures of Figures 2A-2C are grown, these structures have an electrical problem because “there is a need for a nano structure assembly that provides continuous electron transport from the cathode power supply to the field-emitting tips...”. See column 3, lines 35-37 of Choi.

The whole point of Choi is to overcome this problem of lack of continuous electrical conductivity between the carbon nanotubes, regardless of whether the nanotube structure is the structure shown in Figures 2A, 2B, or 2C. This fact is apparent from Figures 3A-3C, which show the metal coating 5 applied to the nanotube structures of Figures 2A-2C. Pertinent description likewise appears at column 5, lines 4-27 of Choi.

It is apparent from elementary principles that there is a lack of electrical continuity in the entangled mass of Figure 2B of Choi. Otherwise, there would be no reason to add the metal coating in Choi. That metal coating is the entire point of Choi. Therefore, Choi cannot disclose in any of Figures 2A-2C or 3A-3C a body of carbon "having a plurality of continuously connected intersecting walls". The assertion to the contrary misconstrues the disclosure of Choi.

With regard to Figure 3B of Choi, Applicants readily agree that the metal coating 5 provides electrical continuity, according to the Choi disclosure, between the elements of the entangled mass of carbon nanotubes. However, neither claim 1 nor claim 15 provides for that kind of electrical conductivity. Instead, both claims require, for anticipation, that a prior art reference disclose a body consisting essentially of carbon and having a plurality of continuously connected intersecting walls. It is the carbon walls that intersect and are continuously connected, not some metal film coating, like the deposited film 5 employed by Choi.

Because of the express differences between the structures of claims 1 and 15, as claimed, and the Choi description, Choi cannot in Figure 3B anticipate either claim 1 or claim 15 nor any of dependent claims 16-20, which depend from claim 15.

The text of Choi cited by the Examiner, namely column 5, lines 28-58, does not alter the foregoing conclusion. The first part of the cited passage only describes problems concerning bending of nanotubes. The latter part of the cited description merely discusses the problems of placing a gate electrode opposite the pointed ends of nano structures, such as shown in Figure 4A of Choi. The cited passage has no relationship to the invention as claimed.

For the foregoing reasons, upon reconsideration, the rejection of claims 1 and 15-20 should be withdrawn.

In the Office Action the Examiner commented on each of the dependent claims. While reply is not necessary because of the clear distinction between claim 15 and Choi, some comments are supplied.

The rejection of claim 16 perpetuates the erroneous assertion that Choi describes continuously connected intersecting walls of carbon. Clearly, there are openings between various of the nanotubes described by Choi, but that fact does not supply the missing continuously connected intersecting walls. Therefore, the rejection of claim 16 is not proper.

As described above, claim 17 encompasses the embodiment of Figures 17 and 18. The second half of the second full paragraph at page 3 of the Office Action repeats the

language of claim 17 concerning the physical arrangement of the extraction electrode with regard to the body of carbon. However, the Office Action fails to cite any part of Choi that depicts or describes such an arrangement. Even conceding, solely for the sake of argument, that a gate, which is intended to control the emission of electrons from Choi's nanotubes, might be considered an electron-extracting electrode, the only description in Choi places the gate electrode directly opposite the nanotubes. See Figure 4A of Choi. That positioning is not the arrangement of claim 17. Therefore, the rejection of claim 17 is not sustainable, independent of the rejection of claim 15.

Claim 18 likewise describes an electric field emission electron source and emphasizes the position of the cathode electrode as being between the body of carbon and the backside extraction electrode. The rejection of claim 18, like the rejection of claim 17, recites the language of claim 18 as examined, but fails to point to any location within Choi that depicts or describes a gate electrode or an extraction electrode located at the side of the nanotubes of Choi, that is opposite the ends of the nanotubes from which electrons are emitted. In fact, there is no such description in Choi.

It is apparent that since Choi cannot anticipate claim 18, Choi cannot anticipate either of claims 19 and 20, claims which depend from claim 18. In addition, it is apparent by comparing the embodiments of the invention pertaining to claims 19 and 20, Figures 21-24, that nothing similar to the claimed structures is described anywhere within Choi, either in the figures or in the text.

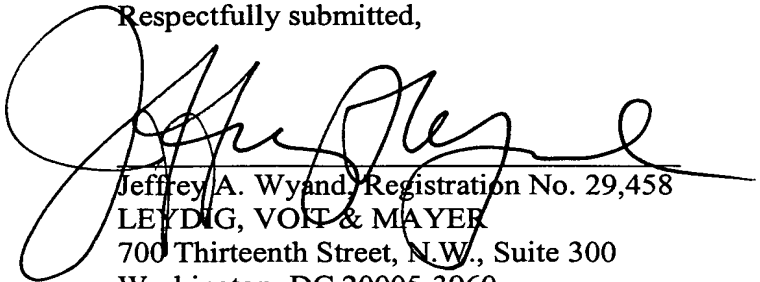
Newly added claims 21-26 correspond to original claims 2 and 4-8. These claims are fully supported in the original disclosure, for example, by Figure 3 and its description. The added claims are patentable because they depend from an allowable independent claim and claim features not shown in Choi.

The rejection of all claims is erroneous for the reasons presented above. Therefore, reconsideration and allowance of all of claims 1 and 15-28, in addition to the acknowledged allowance of claims 9, 13, and 14, are earnestly solicited.

In re Appln. of HOSONO et al.  
Application No. 09/871,979

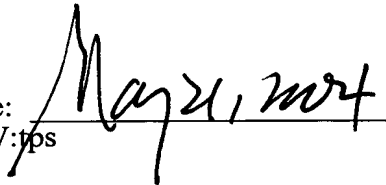
Applicants request a personal interview with the Examiner through their representative.

Respectfully submitted,



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